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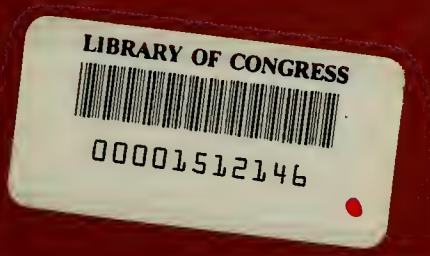

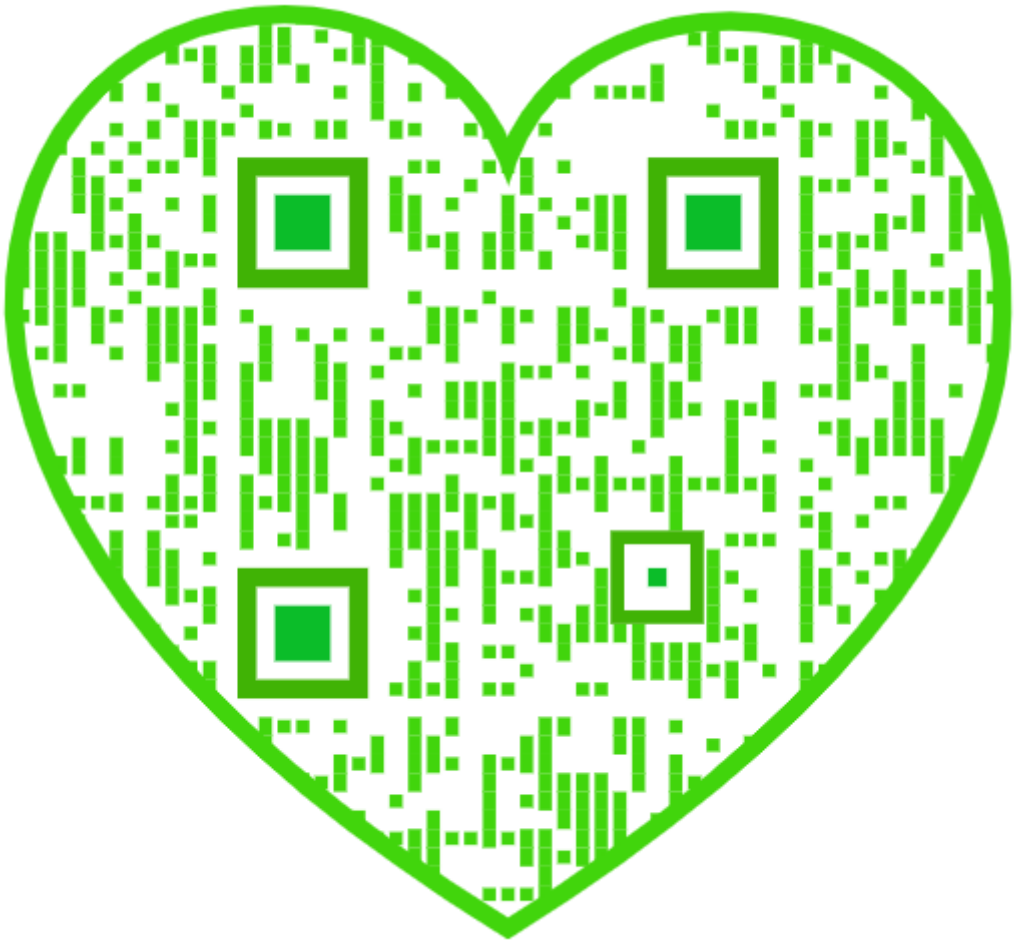

COFFEE PLANTING

HILLMAN

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NITRATE OF SODA
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Coffee Planting

A Short Treatise

Compiled with Special Reference to the Conditions of Culture

IN

Cuba and Porto Rico

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Preface

In the preparation of this brief treatise, the following leading authorities, among others, have been consulted:

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JOSEPH HILLMAN.

London, July, 1902.

Coffee Planting.

A Short Treatise, Compiled with Special Reference to the Conditions of Culture in

Cuba and Porto Rico.

FEW more profitable openings exist for the introduction of capital and the application of well directed energy than are to be found in the skilled cultivation, on scientific principles, of coffee plantations in these tropical neighbours of the United States.

In Cuba, there are said to have been, in 1847, no less than 2,064 plantations under culture with coffee; and the annual crop, notwithstanding the thriftless system of cultivation then existing, amounted to about 50,000,000 pounds annually. From that date the production rapidly declined, and in the last decades of the past century Cuba imported a large proportion of her consumption of coffee from Porto Rico.

During the same period, the cultivation of coffee in Porto Rico increased, but it still remains capable of great expansion on extensive tracts, now almost unproductive, on the hills and in the valleys of the table lands.

The coffee of Porto Rico is distinguished by its high quality, although hitherto it has chiefly found appreciation in the markets of France, Italy and Spain.

Of the coffee of Cuba, it may be said that it responds to careful culture and preparation by a richness of flavour and capacity for heavy yields unsurpassed in any other West India Island or in South America.

These well established facts should point to the revival and development, under present favourable auspices

By Wallace

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of good government and an enlightened agricultural system, of an important and highly lucrative industry.

The fault of the old system of working coffee plantations was that of reckless exhaustion of the soil. Sites were selected, clearings were made, and the land was planted and worked for all it was worth, until its store of available plant food had been used up; then the plantation was abandoned and the process of selection, clearing, planting, cropping and robbery of the soil was repeated.

Such a mode of procedure was—it is scarcely needful to point out—neither rational nor economical. It involved the wastage of large tracts of excellent land, specially suited for the culture of coffee, and a needless sinking of capital. The life of a coffee plantation managed under this vicious system was limited necessarily to a comparatively short term of years.

The abstraction from the soil of the constituents of a succession of crops, of whatever nature, exhausts, sooner or later, the store of natural fertility, or, in other words, the supply of plant food, which the soil originally contained, and sterility, more or less complete, follows for want of the principal plant foods—nitrogen, phosphoric acid, potash and lime; and this sterility or exhaustion can neither be prevented nor remedied by any system of mere cultivation, especially where no rotation of cropping is practicable.

Cultivation carried out with thoroughness will, indeed, hasten the natural processes by which the fertilizing elements contained in the soil are rendered soluble and capable of assimilation by the plant, but it cannot replace what has been removed in the shape of crop, leaves and prunings. On this fact is based the necessity for the use of manures; and in manuring amply and judiciously lies the secret of the maintenance of the plantation.

Before pursuing this branch of the subject, however, it will be well to lay down some rules for guidance in the important matters of soil, climatic conditions and shelter.

The coffee shrub requires a deep soil. If the tap root be stopped by rocks, tufa, or compact clay, the plant dies. The composition of the best coffee soils varies considerably, but in those of Porto Rico it is found that sand is a principal constituent of the majority of them, whilst the surface is rich in humus, the product of decayed forest vegetation.

Heavy clays are altogether unsuitable, and the proportion of clay must, in no case, be such as to induce the retention of stagnant moisture.

Calcareous soils are not suitable, although the presence of a moderate quantity of lime is an advantage.

A relatively high percentage of iron in the soil and sub-soil is not an objection; indeed, ferruginous and silicious soils have been sought after since it has been remarked that the ravages of the *hemileia vastatrix*, or leaf blight, are less frequent and less severe on them than elsewhere.

The presence in the soil of a large proportion of potash, as in the *terra roxa* of Brazil, is undoubtedly an advantage.

A poor sub-soil may be put up with, provided that it be not formed of a damp clay or a compact tufa.

The climatic conditions favourable to the remunerative culture of the coffee shrub are tolerably well understood. The mean temperature of the highlands of both Cuba and Porto Rico, affording as it does a climate of perpetual spring, with a range of scarcely more than eleven degrees between the temperature of the hottest and coldest months, is admirably suited to the requirements of the plant.

In Porto Rico, the finest coffee has hitherto been produced at altitudes between 600 and 2500 feet above the sea level. Upon these highlands, a constant breeze cools the atmosphere, and the well-distributed rainfall, averaging from 60 inches annually at San Juan, to 100 inches in the northeast of the island and upon the highlands of the interior, tends to equalize the temperature of the seasons. Thus, vegetation does not suffer even in periods of comparative drought, whilst during the rainy season the precipitation is seldom torrential. On the southern slope of the island, however, both rainfall and atmospheric moisture are considerably less, so that in some districts irrigation is advantageous, if not absolutely necessary.

As regards Cuba, whilst coffee will grow almost anywhere in the island, it thrives best at altitudes of between 1,500 and 2,500 feet.

The question of shelter and shading is one of some little difficulty. It was formerly the general practice in Porto Rico, and in parts of Cuba, to provide shade trees, under the belief that the coffee shrub would not develop properly or thrive continuously without them. But later

experience has shown that, in the less torrid districts, shade is unnecessary, if not prejudicial. This is explained by the fact that the only benefit afforded by the presence of shade trees is that of lessening the force of the sun's rays; whilst, on the other hand, the consumption of the fertilizing matters of the soil and manures by the shade trees is to the detriment of the coffee plant.

In Java, shading is universal, it is general also in Venezuela; in Brazil, however, the absence of shade trees is believed to ensure larger yields, although it is said by some to lessen the duration of the producing power of the plantation. Voelcker is emphatic as to the advantages of shading in Coorg and Mysore.

On the whole, it may be assumed that shading is a matter in which local practice will be, in most cases, a safe guide, especially if viewed in conjunction with other and economical considerations. In particular, there is the fact that, both in Cuba and Porto Rico, numerous marketable fruits are borne on trees suitable for shade and shelter purposes. Thus, a plantation may be utilized for both fruit and coffee culture without detriment to either, and with corresponding profit to the planter, if only regard be had to proper cultivation and to the adequate supply of available plant foods.

Only in cases where trees of the leguminous order are employed for shade purposes is any complication involved in the question of the nature of the manures to be applied. Plants of the order of *leguminosæ* have the unique faculty of deriving their supplies of nitrogen mainly from the atmosphere, and of accumulating nitrogen in the soil. Thus, in the case of the introduction of plants of this botanical order as shade trees, allowance has to be made for this special store of soil nitrogen when making provision, in the shape of manures, for the nitrogenous plant-food of the coffee shrub. It has, however, to be borne in mind that it is only the requirements of the plantation in nitrogen that are thus affected; the leguminous shade trees, like those belonging to other orders. making demands upon the constituents of the soil and manures for the phosphates, potash, lime and other mineral elements of their plant-food.

Where it may be deemed advisable to plant shade trees, simply as such, the Albizzia Lebbeck—the French *Bois noir*,—which has always been employed by coffee planters

in the Antilles, would appear to unite the greatest number of desirable qualities and, locally at least, to give the best results.

The Brysonima spicata is a shade tree much employed in the British West Indies. It possesses the advantages of sparse foliage, rapid growth, of affording shelter against the wind as well as the sun, of great hardiness and of not attaining too great a size.

The method of propagation which has, in the past, been largely adopted in Porto Rico, by utilizing off-shoots and self-sown plants, is to be deprecated, and the system of sowing carefully selected seed in specially prepared seed-beds is that which should be followed.

The site chosen for the seed-bed should be on a slight incline, so as to afford natural drainage; it should occupy a sheltered position and possess a good surface layer of vegetable soil, which must be worked until a fine tilth is secured. It will have been cleared of all roots, stones, etc., and, in most cases, it should be enriched with a good dressing of well-rotted barnyard manure.

The sowing is best made in the month of February, and the coffee grains to be sown should be selected for their size, weight and perfect formation. The grains are planted at a depth of about an inch and a half, the finger or a small stick being used for the purpose, and after they are placed in the hole the earth is pressed down over them with the hand. The sowings should be made in rows distant about six inches from each other, the space between each grain sown being the same. In about twenty days the young coffee plants will begin to appear, and they will remain in the seed-bed for a year and a half, when they will have attained a height of about thirty inches and be ready for transplantation to the site selected for the coffee grove.

The seed-beds must be carefully kept free from weeds, and be irrigated frequently with small quantities of water, so as to maintain a constant, but not excessive degree of moisture; provision must be made also for sheltering the young plants from excessive solar heat and from strong winds.

Before transplantation, the lower branches of the young shrub are cut away, so as to obtain a clean and straight stem with a crown at a convenient height for the gathering of the crop.

Coffee Planting

The best season for transplantation is the autumn equinox.

To obtain maximum yields, the following directions must be carefully adhered to in laying out the plantation:

1. Select a fertile soil, rich in humus, and lying so that natural drainage and a good aspect are secured.
2. Pick out vigorous and well-grown young plants. They must be removed without breakage of the roots and with a good ball of earth about them.
3. If the tap root project beyond the ball of earth, it should be cut with a sharp knife, reducing it to a length of about eight inches.
4. Plant in rows eight feet apart and at a distance of eight feet in the rows. This will give approximately 700 plants to the acre. This as a general rule, but in the case of exposed situations closer planting is advisable. In such conditions, small, compact trees, topped at about 2 feet 6 inches, will give the best results.
5. Plant in rainy weather and with the soil in a tolerably moist condition.
6. Previous to planting, prepare holes eighteen inches square and eighteen inches in depth. In preparing the holes, the surface soil should be placed to the right, and the soil from the bottom of the hole to the left. The latter should be mixed with about two pounds of well-rotted dung. About eight days should intervene between the opening of the holes and the planting. The surface soil, which from having been exposed to the atmosphere is most suitable for contact with the roots, is first to be used, and the hole is then to be filled up with the remaining, manured soil. The plants must be carefully placed and the holes filled so as to leave no lodgment for water.
7. Three or four months after the planting, the ground should be gone over and any dead or unsatisfactory plants be replaced with others of the like size, so that the entire grove may develop evenly.
8. All suckers and undesirable shoots must be removed as soon as they appear.

To obtain maximum crops and to avoid inequalities and intermittency of yield, so far as seasons and weather will permit, must be a chief aim of the planter; and questions of soil, planting, pruning and cultivation having been carefully studied, the application of suitable fertilizers in adequate quantity and in proper season becomes the paramount consideration.

In the past of coffee-growing in the Antilles, rational manuring did not exist. At most, the pulp and parchment were returned to the soil, and any barnyard manure that might be available was applied haphazard. In fact, the capital stock of the land was the bank drawn upon for the production of crops.

Under a better system of agriculture, the application of dung or barnyard manure is the time-honoured method of restoring to the soil the elements of plant-food of which successive crops have depleted it; but an adequate supply of barnyard manure is not always available, and the carriage of so bulky a material is costly. Moreover, although farmyard dung is, in a general sense, rightly termed a complete manure, and is especially valuable for its mechanical action on soils, the proportions in which the principal constituents of plant-food occur in it do not correspond to the requirements of the coffee shrub, and barnyard manure will need to be supplemented if heavy cropping and healthy growth are to be secured.

At the present day, the application of the scientific principles which underlie the question of plant-foods and their supply, is become general, and the grower, whether of farm crops, garden stuff or fruits, looks to the teachings of agricultural science for guidance in maintaining the soil of the farm or plantation in such high condition as to ensure maximum yields and enable the plants to resist unfavourable seasons and the attacks of parasites by sustained vigour of growth.

The planter cannot be too strongly recommended to have the composition of the soil of his plantation ascertained by careful analysis, made by an expert agricultural chemist. The incidental cost will be amply compensated by the clear indications which such analysis will afford in determining the nature and quantities of the manures to be applied. There is more money sunk in ignorant and careless systems of manuring than many proprietors think.

It has to be borne in mind that, to manure successfully, it is necessary to be acquainted not only with the food requirements of the plant and crop, but also with the constituents available in the soil for supplying the foods. From a comparison of the demands made by the crop and the materials at hand for meeting them, we discover what deficiencies exist and are able to determine the most suitable and economical materials for supplying them.

The results of analyses of the various parts of the coffee shrub, and particularly of the grain, show very considerable discrepancies, but the essential data which bear upon the manuring of the plant may be arrived at without difficulty. They indicate that nitrogen and potash are the dominant constituents of the shrub and its fruit. Thus, for every 1,000 pounds of merchantable coffee produced, about twenty-four pounds of nitrogen, twenty-nine pounds of potash and four pounds of phosphoric acid are removed from the soil. Lime also is an important factor, and, if it be deficient in the soil, an occasional artificial supply of sulphate of lime, or slaked lime, will be attended with good results. Especially on flat land, rich in vegetable remains, lime is valuable for improving the physical as well as the chemical condition of the soil.

From a well-managed plantation in full yield, an average crop of one and one-half pounds of dressed coffee per tree should be readily attainable; and this is the minimum result of careful cultivation and liberal manuring that should be aimed at.

Thus, an acre of plantation, representing 700 trees thoroughly cultivated and in full bearing, may, at a moderate estimate, be taken to yield 1,050 pounds of dressed coffee annually.

Much larger and considerably smaller average yields are obtained in other coffee-growing countries. In Ceylon, before disease ravaged the plantations, yields of 20 cwt. per acre were not infrequently attained, and this is said to be also the case in Guatemala. In Mexico, crops of two and one-half pounds, and in Brazil three pounds, per shrub are said to be common; whilst, on the other hand, in Venezuela the average yield is reckoned scarcely to exceed one-half pound per tree.

In adopting the figure of one and one-half pounds of dressed coffee as the lowest yield per tree that the planter

should look to attain, we have in view the fact that it is always better to manure for a maximum crop when calculating the fertilizing elements to be supplied to the soil.

As we cannot, in the present state of our practical and scientific knowledge, calculate exactly, in the case of a particular crop or of a particular soil, the quantities of phosphoric acid and potash to be supplied in order to produce the largest yield, or, what is the same thing, in order to bring into full activity the assimilable soil nitrogen and the nitrogenous manure that is to be applied in conjunction with them, the rational course to be taken is that of securing an *excess* of both phosphoric acid and potash in the soil. There is no risk of waste or loss in so doing, for both these plant-foods are *fastened up* in the soil, and will be retained by it for later crops if the next following crop is unable to utilize the whole of them.

With Nitrogen it is otherwise. The Nitrogen is *not* fastened up by the soil, but remains freely movable, and any residue left unutilized by the particular crop will, in great part at least, be washed down during the succeeding rainy months and be lost. The Nitrogen applied in manures has therefore to be *measured out* to each successive crop as exactly as possible.

Duly weighing the foregoing considerations, we arrive at the conclusion that the following may be taken as a standard formula—to be modified according to local circumstances—of chemical manures to be applied annually per acre of coffee plantation containing 700 adult trees in full bearing:

Nitrate of Soda.....300 pounds.
Superphosphate of lime...450 pounds.
Sulphate of Potash.....250 pounds.

In suggesting the foregoing quantities, we have kept in view the average food requirements of shade trees. Should these, however, be of a kind intended to bear heavy crops of fruit, and thus making large demands upon the constituents of the soil and manures, the volume of the chemical fertilizers applied will have to be judiciously increased.

One of the main points to be considered in relation to the advisability of modifying the formula given above will be the contents of the soil in lime. As we have already said, recourse to a chemical analysis is strongly to be recommended, but, failing this, the grower may easily determine

for himself, in a rough and ready way, whether the soil of his plantation contains a fair and practically sufficient quantity of lime.

To quote from "Fertilizers and Feeding Stuffs"—a useful manual from the pen of Dr. Bernard Dyer:

> "It is only necessary (for this purpose) to obtain a fair sample "of the soil and to dry and powder it and to treat it with some "common hydrochloric acid ('spirits of salts').
>
> "If the soil contains much vegetable or organic matter, a "couple of ounces may be first heated red hot on an iron shovel over "the fire. The soil (or its ashes) should then be placed in a tumbler "and mixed with water to a thin paste. A couple of ounces of the "hydrochloric acid are then poured on it and stirred up with a stick "of wood. If the soil effervesces briskly, there is a sufficiency of "carbonate of lime. If the effervescence is so slight as to be "scarcely noticeable, it is certain that the soil is very poor in lime."

If the result of this simple test shows a deficiency of carbonate of lime—and it is only lime present in the form of carbonate of lime that affects the question—it will be well to mix thoroughly the 450 pounds of superphosphate indicated in the formula with an equal weight of bone dust, allowing the mixture to stand for some little time before being used. As an alternative, 800 pounds of basic slag (Thomas phosphate) may be used instead of the superphosphate of the formula. When, to provide for the case of a deficiency of lime, either of these substitutes for the superphosphate is used, it should be well incorporated with the soil, and it will be unnecessary to apply any phosphatic manure in the following year, the sulphate of potash and the Nitrate of Soda of the formula being, however, used every year.

A recently introduced fertilizer—the "basic superphosphate," patented in England by Mr. John Hughes—which is superphosphate "precipitated" or neutralized by the addition of lime, forms a useful phosphatic dressing for soils poor in lime. In its case also, 800 or 900 pounds per acre should be used to take the place of the smaller quantity of acid superphosphate; and, like basic slag, it should be applied every other year.

It may be well to point out here that coffee soils being generally rich in humus, it will usually be the case, at the outset of the life of the plantation, that Nitrogen is present in quantity more than sufficient to meet the requirements

of the shrub for the production of several successive crops. But, on the other hand, this Nitrogen will be in organic form, and will only become available for plant food after it has been converted into Nitric acid and Nitrates by the natural processes known as Nitrification. Under the conditions of tropical climate and rainfall, provided there be a sufficiency of lime in the soil, the processes of Nitrification will go on with relative rapidity throughout the year. But, during the large portion of the year represented by the rainy season, the Nitric acid and the resulting Nitrates formed from the soil humus will be washed down and quickly pass into the sub-soil, so that there will be but scant accumulation of them in the surface soil, in which alone they can be reached by the rootlets of the shrub and be assimilated to build up the structure of the plant and go to feed the crop.

It is in these circumstances that applications of Nitrate of Soda have their special advantage. The Nitrogen of Nitrate of Soda is in a form in which it can be immediately taken up by the plant and is at once available for its nourishment. It can therefore be measured out for the supply of its nitrogenous wants in the development of foliage, flower, fruit and wood.

The pulp and parchment of the coffee berry will, on a well-managed plantation, be restored to the soil, either alone or after being mixed with a little lime and watered, which will hasten their decomposition.

In addition to a moderate proportion of potash, coffee pulp in its natural state contains about 0.330 per cent of Nitrogen; and the best method of utilizing it is by mixing it with concentrated fertilizers like superphosphate or wood ashes. It should be placed under cover and not be allowed to wash out.

Wood ashes form a concentrated potash manure, and where they can be had in quantity they should be applied together with the pulp, the bulk of which will facilitate their uniform distribution.

It has to be remembered that potash enters largely into the composition not only of the coffee bean, as has been shown above, but also of the leaves and young wood of the tree.

Obviously, the restoration to the soil of the pulp and parchment will diminish to an extent corresponding to their contents in Nitrogen and potash the quantity of chemical manures to be applied in compensation for what has been removed by the crop.

Most soils naturally suitable to coffee contain magnesia in abundance; some Jamaica soils contain upwards of two per cent. of it after having been in coffee for a long series of years. In the case of soils that may be shown by analysis to be deficient in magnesia, it will be well to substitute for the sulphate of potash in the formula given above 500 to 600 pounds of kainit.

Where the soil of the plantation is distinctly poor in lime, the deficiency may be supplied by the application, at intervals of two or three years, of 400 to 500 pounds of gypsum (sulphate of lime) per acre. In such conditions, a dressing of gypsum often produces excellent effects, since it renders available the potash present in the soil, besides supplying lime in a readily assimilable form for the needs of the shrub.

Where dung is available, it should be put on at as frequent intervals as possible—say of from four to six months—and, in the meantime, the heaps should be protected from being washed by rain by a covering of soil beaten as hard as possible.

The general state of vegetation on the plantation will afford guidance as to the greater or less quantity to be applied of the several manures. On estates where it is observed that the trees are making plenty of wood and leaf, the supply of nitrogen is evidently adequate; on the other hand, on washed estates, it will almost certainly need to be increased. The appearance of numerous shoots up the stem may be taken as an indication that the manuring errs on the side of excess; a good and sufficiently manured bush will have a healthy growth of new wood on the branches to form the fruit-bearing branches of the succeeding year.

It is more prudent and economical to manure and prune for a heavier crop than for a lighter. If a high proportion of the blossoms set, and fear is entertained of the trees overbearing, they may be assisted in time by the application, in May, June or, at the latest, in July, of an additional dressing of quick-acting manures in the form of Nitrate of Soda, superphosphate of lime and sulphate of potash.

In dealing with a neglected estate, discouragement must not be felt if the first application of fertilizers does not bring about all the results that are desired. It has to be borne in mind that the trees will need to be brought into condition. Their partially dried up arteries, through which

the impoverished sap is only languidly circulating, have to be restored. And when the planter has secured a remunerative crop, he must not think that he has done enough. He must persist in the course which has brought about the improvement. Manuring must not be intermitted even for a single season. Instances are only too numerous of the disastrous results of starving estates previously well cultivated, and of false and short-sighted economy which has cost owners thousands of dollars in addition to the deterioration of the properties.

A point that should be steadily kept in view is that moderate and frequent applications of well-balanced manures are decidedly the most effective and the most economical.

The superphosphate and potash of the formula given above, as also the pulp and parchment after having been treated in the manner suggested, should be applied shortly after the gathering of the crop has been completed, advantage being taken of the plowing given at that period to turn them under.

The Nitrate of Soda should be applied broadcast, in two or, better still, in three equal dressings, at intervals of about a fortnight, the last dressing being given not later than the second week in February.

The practice of depositing the fertilizers in close proximity to the stems of the shrubs is to be avoided. The dressings should be distributed as evenly as possible over the entire area beneath the branches of the coffee shrubs and of the shade trees.

Constant attention must be given to the mechanical cultivation of the soil, and it should never be allowed to become hard. Ordinarily, two plowings are given; the first shortly after the crop has been gathered and the second five or six months later, advantage being taken of a period when the soil is in good working order. To go on the land when it is wet is certain to do harm. Perfect drainage—either natural or artificial—is of the greatest importance.

Where the site of the plantation does not allow of the use of the plow, cultivation by the spade or the fork has to be substituted, the soil being stirred to the depth of about a foot, in order to favour the retention of moisture and to obtain the greatest possible advantage from the rainfall.

Great care must at all times be taken to avoid injury to the main lateral roots of the plant in the process of cultivation. It is especially important not to plow, or even to hoe deeply, at the time of flowering, in order not to destroy the delicate hairs which the rootlets of the shrub put forth at that period. These root hairs are believed to have for their purpose the supply of additional nourishment to the plant to assist in the formation of the fruit.

Hoeing should be specially attended to immediately before the period of flowering, in order to destroy weeds and stray plants which would otherwise appropriate the manures applied for the nourishment of the crop and would also tend to choke the plants and monopolize air and light.

Where irrigation is had recourse to, it should not be too frequent or in too great quantity, since the effect of an opposite course is said to be to diminish the aroma and thus to depreciate the quality of the crop. At the period of flowering, irrigation must be suspended, even rain being prejudicial to the formation of the berry.

At all stages of their growth, the trees must be systematically and carefully pruned, with the object of keeping them open, so as to insure the penetration of light and the free circulation of air, and so also as to preserve only such portions of the wood as will bear fruit abundantly and of good quality. As in the case of plants in the seed-beds, so in the plantation, all suckers and undesirable shoots must be removed immediately they appear.

We have advisedly abstained in these pages from multiplying specific directions, especially any of a hard-and-fast character. Such guidance is, for the most part, unnecessary in the case of the practical grower, and it might be worse than useless to the inexperienced planter, since the adoption of such rules must be largely subordinated to considerations of soil and season and to the special conditions existing on the particular plantation.

The object which we have had in view has been that of stating and enlarging upon the broad and fundamental principles which must underlie and govern all sound and successful practice.

THE Chilean Nitrate Propaganda is not engaged in the sale of Nitrate of Soda, but will furnish a list of dealers to all who apply for it.

It should be remembered that the original package of Nitrate of Soda contains approximately 300 lbs. of normally dry Nitrate of Soda. Sacks of 100 lbs. and 50 lbs. are now on the market.

Nitrate of Soda is generally sold in the original packages and should be stored or kept in a dry place. Glass Works and Manufacturers of Dynamite and Gunpowder usually have Nitrate on hand.

If you have any difficulty in obtaining Nitrate, either by reason of prohibitive prices or undue delay or on account of inability of dealers to supply you promptly, let me know at once, and the difficulty will be investigated immediately.

Correspondence concerning freight charges is invited.

WILLIAM S. MYERS, Director

CHILEAN NITRATE WORKS

12 John St., New York

OMMUNICATIONS received from farmers and prospective consumers interested in the use of Nitrate of Soda, who are unable to secure it in their immediate vicinity, will be promptly referred to reliable dealers who will furnish them with this special fertilizer. Formulas and valuable information sent free.

Below will be found a list of pamphlets relating to the use of Nitrate of Soda as a fertilizer, which will be furnished gratis to persons desiring information upon any of the subjects named, by applying to

WILLIAM S. MYERS

12 John Street ✦ New York

How Money Crops Feed.
How to Use Nitrate.
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Field Experiments on Market Garden Crops.
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Sugar Beets for Profit.
Olive Culture.
Stable Manure and Artificial Fertilizers upon Fruit Trees.
Usefulness and Comparative Value of Nitrogen in Commercial Forms.
A Review of the Present Knowledge of Sodium Nitrate, together with the Origin, Production and Destruction of Nitrates in the Soil.
Grass Experiments.
Market Gardening with Nitrate.